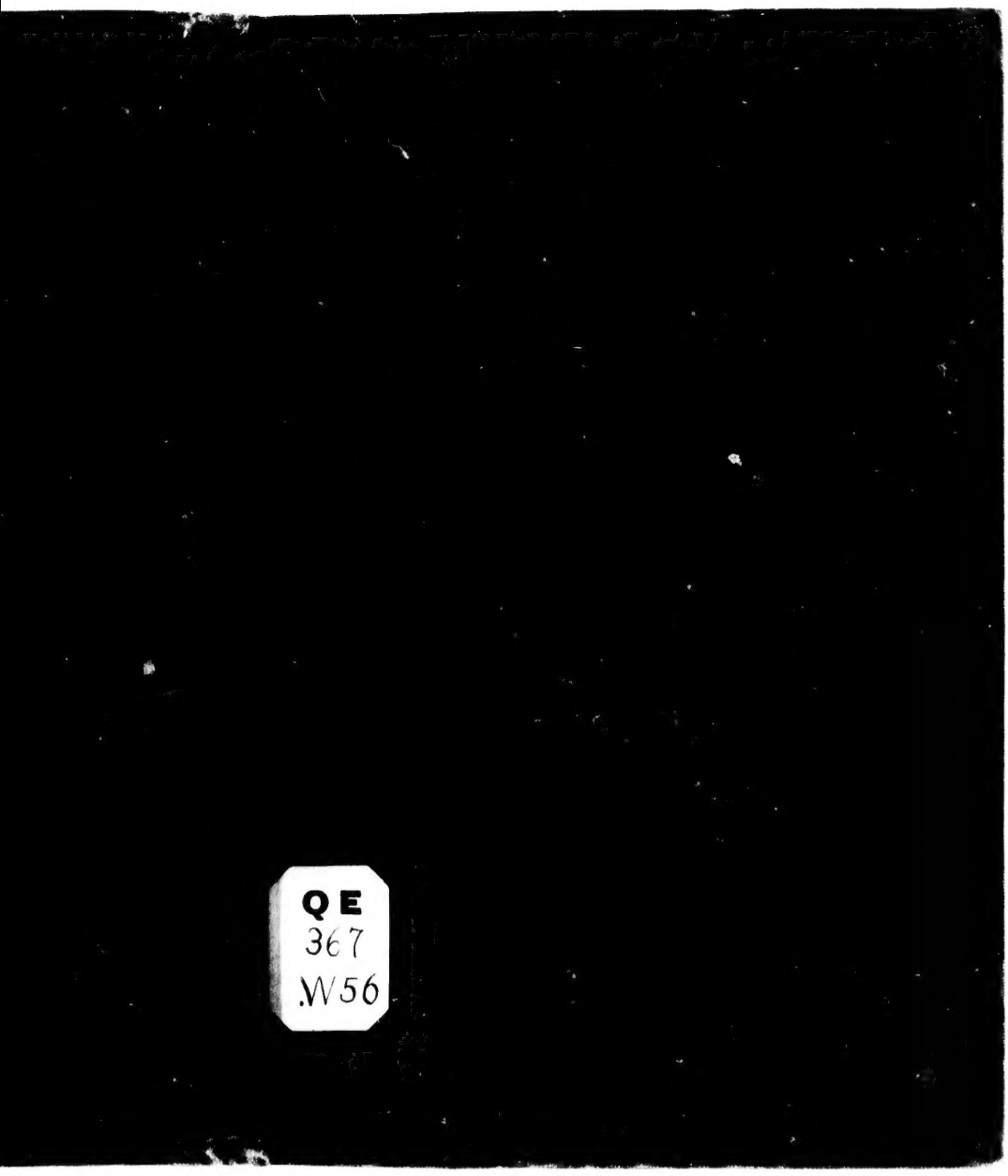
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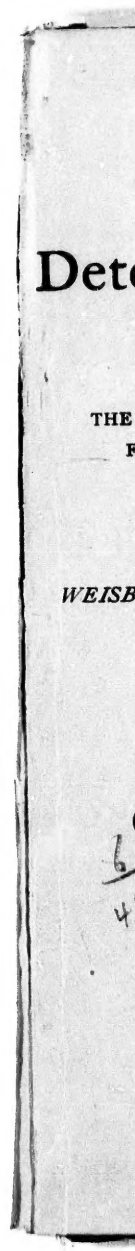
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AN ELEMENTARY GUIDE

TO

Determinative Mineralogy

FOR THE USE OF

THE PRACTICAL MINERALOGIST AND PROSPECTOR, AND
FOR INSTRUCTION IN SCHOOLS AND ACADEMIES,

BASED UPON THE METHOD OF

WEISBACH'S "TABELLEN ZUR BESTIMMUNG DER MINERALIEN,"

APPLIED CHIEFLY TO AMERICAN SPECIES.

C. GILBERT WHEELER,

Professor in the University of Chicago.

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PREFACE.

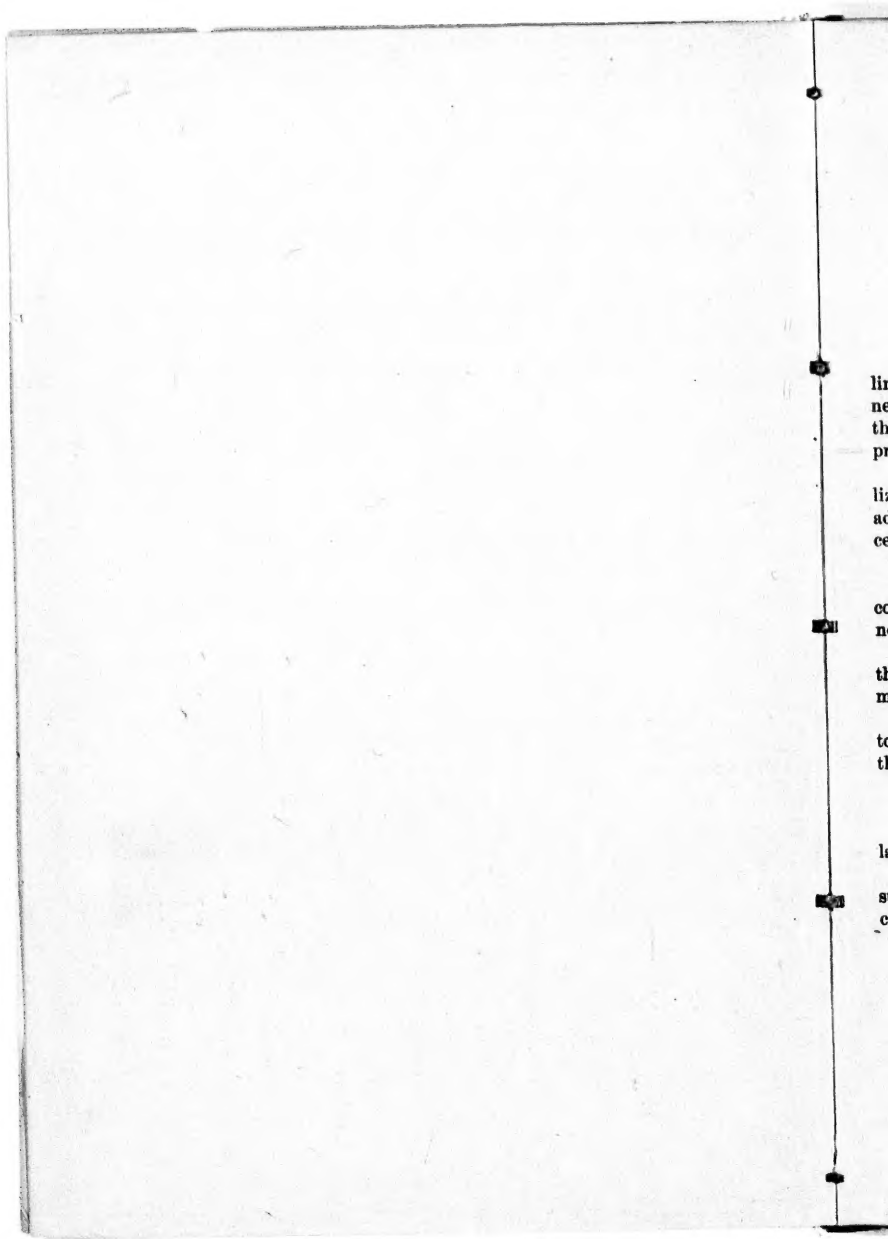
It is now usual in our leading academies, high schools and similar educational institutions to impart instruction in the natural sciences, not merely by text-book and class-room drill, but also by means of actual elementary practice in such experiments or observations as are carried on by those who devote themselves to the investigation of natural phenomena. Heretofore, these hours of practice have been mainly devoted to Botany and Zoology, as material in these departments is everywhere at hand and inexpensive. Some institutions have also added somewhat of laboratory practice in the department of Chemistry. Most teachers recognize that by these methods the sciences themselves are studied, and not merely what compilers of text-books have collated concerning them.

In view of the very general interest at present taken in the mineral development of our country, especially in our Western States and Territories, it is now eminently fit that the students at our better institutions should secure some slight training in practical mineralogy, at least sufficient to enable them to recognize the more important minerals and ores. It is no longer difficult to obtain specimens. Few schools even now are entirely without them, and either by donation or exchange the collections can readily be increased. Many dealers supply sets of minerals, complete enough for the ordinary requirements of a practical course, at a cost of but a few dollars.

In this work minerals not found in the United States, or the mining regions of Mexico, are for the most part omitted. The exceptions are such foreign species, only, as are found in most collections. By thus eliminating minerals rarely encountered it is claimed that this little manual is thereby rendered much more useful, as it often occurs, in the use of larger works, that more time and labor are required to ascertain that a given mineral is not some rare, foreign one, than it would to determine half a dozen ordinary specimens.

Throughout the work the names of species and the physical and chemical characteristics are those given in Dana's Mineralogy.

C. GILBERT WHEELER.



INTRODUCTION.

In the use of these tables where the lustre, hardness, streak, color, crystalline form and cleavage can be determined, there can scarcely be any difficulty or need of explanation as to the method of procedure. A simple inspection of the tables themselves, or of the synopsis of their arrangement, on the page preceding the index, will make a detailed explanation quite unnecessary.

Where, as in the case of some silicates, etc., on account of imperfect crystallization, special difficulties present themselves, the supplementary tables are added where, with an acid, a blow-pipe and a couple of fluxes, a still greater certainty may be obtained and additional species recognized.

In general it may be remarked:

I. The indicated nature and degree of lustre, as well as the variety of color, are invariably those of fresh fractures, a fact which the beginner should not overlook, especially if the mineral have a metallic lustre.

II. Friable, slightly coherent minerals are to be found in the second table, their streak being identical with their color; in rare cases some of them, as magnetic iron ore and argentite, are in the first series.

III. The indicated degree of hardness are average amounts with reference to crystalline faces, or, in non-crystallized minerals, to fresh fracture surfaces; this is to be considered particularly with fibrous or scaly minerals.

IV. The scale of hardness is the one of Mohs.

V. The crystallographic terms are those of Dana.

It has been deemed expedient to distinguish the common minerals by larger, the more rarely occurring by smaller type.

The numbering of the species it was believed would be a convenience for such as might desire to apply the classification in the arranging of their collections.

I. MINERALS HAVING

I.

No.	Name.	Hardness.	Color.	Streak.
1	**COPPER**	2·75	copper-red	copper-red
2	**Breithauptite**	5	copper-red	reddish brown
3	**NICCOLITE**	5·25	light copper-red	black

II.

No.	Name.	Hardness.	Color.	Streak.
4	**GOLD**	2·5	gold-yellow	gold-yellow
5	**Electrum**	2·5	pale yellow	pale yellow
6	**BORNITE**	3	copper-red to brown	gray black
7	**Millerite**	3–3·6	brass-yellow to bronze-yellow	bright black
8	**PYRRHOTITE**	3·5–4·5	bronze-yellow	gray black
9	**CHALCOPYRITE**	3·5–4	brass-yellow	green black
10	**Homichlin**	4	bronze-yellow	black
11	**PYRITE**	6	brass-yellow	brown black

AVING

I.

Streak.
pper-red
ddish brown
ack

II.

Streak.
old-yellow
ale yellow
ray black
right black
ray black
reen black
lack
rown black

A METALLIC LUSTRE.

Red.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
malleable	isom.		G. 8·8.
brittle	hex.		G. 7·5.
brittle	hex.		G. 7·3–7·7.

Yellow.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
malleable	isom.		G. 15 to 19·5.
malleable			G. 15·5.
brittle	isom.	small conchoidal and uneven	G. 4·4–5·5.
brittle	hex.	rhombohedral and perfect	G. 4·5–5 7.
brittle	hex.	granular	G. 4·4. Is usually attracted by magnet.
brittle	tetr.	uneven	G. 4·1–4·3.
brittle	tetr. (?)	uneven	G. 4·4–4·5.
brittle	isometric.	uneven	G. 5. Strikes fire with steel.

III.

No.	Name.	Hardness.	Color.	Streak.
12	**Mercury**	fluid	tin-white	
13	**BISMUTH**	2·25	reddish white	gray
14	**Tellurium**	2·5	tin-white	tin-white
15	**SILVER**	2·5	silver-white	silver-white
16	**Hessite**	2·5	gray zinc-white	gray
17	**ANTIMONY**	3	tin-white	tin-white
18	**Altaite**	3·25	tin-white	tin-white
19	**Domeykite**	3·5	tin-white	gray white
20	**ARSENIC**	3·5	tin-white	dark white
21	**Whitneyite**	3·5	grayish to reddish white	reddish white

White.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
			G. 13·5.
brittle when cold	hex.		G. 9·7.
brittle	hex.	lateral perfect, basal imperfect	
ductile	isometric		G. 9·4.
sectile	orthorhombic	indistinct	G. 8·3.
very brittle	hex.	basal perfect	G. 6·6.
sectile	isometric	cubic	G. 8·1.
	reniform	uneven	G. 7.
brittle	rh.	uneven and fine granular	G. 6.
malleable	not distinct	fresh fracture dull	G. 7·6. Rubbed surfaces strongly metallic

No.	Name.	Hardness.	Color.	Streak.
22	**Gersdorffite**	5	silver-white	gray black
23	**Leucopyrite**	5·25	silver-white	gray black
24	**SMALTITE**	5·5	tin-white to steel-gray	gray black
25	**Arsenopyrite**	5·5	silver-white	dark gray black
26	**Iridosmine**	6	tin-white	black

IV.

No.	Name.	Hardness.	Color.	Streak.
27	**MOLYBDENITE**	1·25	pure lead-gray	lead-gray
28	**LEAD**	1·5	lead-gray	gray
29	**Sylvanite**	1·5	steel-gray	steel-gray
30	**Tetradymite**	1·75	pale steel-gray	pale steel-gray
31	**PYROLUSITE**	2	iron-black to dark steel-gray	black or blue-black

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
brittle	iso.	uneven	G. 7·6.
brittle	hex.	uneven	G. 7·6.
brittle	iso.	octahedral and distinct	G. 7·6.
brittle	orthr.	uneven	G. 6.
malleable with difficulty	hex.		commonly in irregular, flattened grains.

Gray.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
sectile and almost mall'ble	hex.	in laminæ	G. 7·4.
ductile and malleable	iso.		G. 7·6.
	mkl.	uneven	G. 7·6.
not very sectile.	hex.	laminæ flexible.	G. 7·6. Soils paper.
brittle	ortho.		G. 7·4.

No.	Name.	Hardness.	Color.	Streak.
32	**STIBNITE**	2	lead-gray	lead-gray
33	**BISMUTHINITE**	2	lead-gray	lead-gray
34	**ARGENTITE**	2·25	black lead-gray	black lead-gray
35	**STEPHANITE**	2·25	black gray to iron-black	iron-black
36	**GALENITE**	2·5	lead-gray	lead-gray
37	**CHALCOCITE**	2·5	lead-gray	lead-gray
38	**Berthierite**	2–3	dark steel-gray to pinchbeck-brown	iron-black
39	**Dyscrasite**	3·5	gray to white	silver white
40	**TETRAHEDRITE**	3–4·5	light flint-gray to iron-black	same or brown red
41	**Platinum**	4·5	whitish steel-gray	whitish steel-gray

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
sectile	orthorh.	laminated	G. 7·4.
slightly brittle	orthorh.		G. 7·6.
sectile	iso.	uneven	G. 7·6.
slightly	orthorh.	uneven	G. 7·6.
frangible	iso.	flat or even	G. 7·7.
	orthorh.	conchoidal	G. 7·5.
	prism. or massive	granular	G. 7·4.
sectile	orthorh.	uneven	sometimes tarnishes, yellow and blackish.
slightly brittle	isometric tetrahedral	uneven	G. 7·5.
ductile	iso.	hackly	G. 7·6. Occasionally magnetic-polar.

No.	Name.	Hardness.	Color.	Streak.
42	**Iron**	4·5	iron-gray	shining
43	**SMALTITE**	5·5	tin-white to steel-gray	gray black
44	**Hematite**	5·5	dark steel-gray iron-black; where earthy, is red	cherry-red or reddish brown

V.

No.	Name.	Hardness.	Color.	Streak.
45	**GRAPHITE**	1	iron-black dark steel-gray	black, shining, soils paper
46	**Polybasite**	2–3	iron-black in thin crystals, cherry red	iron-black
47	**Stephanite**	2·25	black gray to iron-black	iron-black
48	**Stromeyerite**	2·5	black to steel-gray	shining
49	**Miargyrite**	2·5	iron-black	cherry-red
50	**Enargite**	3	iron-black to grayish	grayish black
51	**Coloradoite**	3	iron-black	

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
ductile	iso.	hackly	magnetic
brittle	iso.	uneven	G. 7·6.
brittle	rhomb.	uneven	sometimes attracted by magnet.

Black.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
thin laminæ flexible	hex.	sectile	G. 7·2. Feels greasy.
	ortho.	uneven	G. 7·6.
	massive	none	G. 7·7.
	ortho.	sub-chon.	G. 7·6.
	mkl.	sub-conch.	G. 7·5.
brittle	ortho.	uneven	G. 7·4.
	amorph.	sub-conchoidal	G. 8·6. Decrepitates.

No.	Name.	Hardness.	Color.	Streak.	T
52	**Tenorite**	3	gray black	gray black soils fingers	slig
53	**Melaconite**	3	iron-gray to gray black	gray black soils fingers	slig
54	**Manganite**	4	iron-black to dark steel-gray	reddish brown to black	slig
55	**Hausmannite**	5	brown black	chestnut-brown	bri
56	**MAGNETITE**	5	iron-black	black	bri
57	**Menaccanite**	5	iron-black	black to red brown	bri
58	**Chromite**	5·5	iron-black to brown black	brown	bri
59	**Franklinite**	5·5	iron-black	dark red-brown	bri
60	**Hematite**	5·5	dark steel-gray iron-black; where earthy, is red	cherry-red and reddish brown	br an
61	**Tantalite**	6–6·5	black	brown black	br

Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
ay black ils fingers	slightly brittle	hex.		G. 6.
ay black ils fingers	slightly brittle	iso.		G. 7·6.
ddish brown to ack	slightly brittle	ortho.	uneven	G. 7·4.
estnut-brown	brittle	tetra.	uneven	G. 7·4.
lack	brittle	iso.	sub-conch.	G. 7·4. Strongly magnetic.
lack to red brown	brittle	rhom.	conch.	G. 7·4. Slightly magnetic.
rown	brittle	iso.	uneven	G. 7·4. Slightly magnetic.
lark red-brown	brittle	iso.	conch.	G. 7·5. Slightly magnetic.
herry-red and eddish brown	brittle, scaly and fibrous	rhom.	uneven	Sometimes att'd by magnet.
rown black	brittle	orthorh.	conch.	7–8. No change before blowpipe.

II. SUB-METALLIC

WITH BLACK, BROWN, RED, YELLOW,

I. Black

No.	Name.	Hardness.	Lustre.	Color.	Strea
62	**Asphaltum**	1·25	like black pitch	black, brownish black	brown-
63	**MINERAL COAL**	2·5	dull to brilliant earthy, resinous or sub-metallic	black to dark brown	black
64	**Anthracite**	2·5	lustre bright, sub-metallic.	black	black
65	**Petzite**	2·5	iron-black	black	grayish
66	**Sphalerite or Blende**	3·5	resinous to adamantine	brown, yellow, black, red, green, white.	grayish to red brown
67	**Ilvaite**	5·5	sub-metallic	iron-black, dark grayblack	black or bro
68	**Psilomelane**	5·5	sub-metallic	iron-black to dark steel-gray	brown shinin
69	**Braunite**	6·25	sub-metallic	dark brownish black	dark ish bl

ETALLIC

RED, YELLOW,

I. Black

MINERALS,

GREEN OR BLUE STREAK.

Streak. (All are opaque.)

Color.	Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
black, brownish black	brown-black		amorph.		Mineral pitch. Melts at 90° and burns with bright flame.
black to dark brown	black	brittle	amorph.	rarely somewhat sectile	G. 1. Infusible to subfusible. Often soft or pasty when heated.
black	black	very brittle	amorph.	conchoi.	Burns with feeble flame of a pale color.
black	grayish black		orthorh.	prismatic	Soluble in aqua regia with separation of silver chloride.
brown, yellow, black, red, green, white.	grayish black to reddish-brown	brittle	iso.	conch.	G. 7·4. Sub-fusible.
iron-black, dark grayblack	black to green or brown	brittle	ortho.	uneven	G. 7·3.
iron-black to dark steel-gray	brown black, shining	brittle	amorph.		G. 7·4.
dark brownish black	dark brownish black	brittle	tetra.	uneven	G. 7·4.

II. Brownish

No.	Name.	Hardness.	Lustre.	Color.	Stre
70	**Ozocerite**	1	waxy	yellowish green, brown and black	yellow to blac
71	**Hepatic Cinnabar**	2·25	greasy, inclined to metallic	liver-brown	brown
72	**Brown Coal** (Lignite)	2·5	greasy	brown to black.	brown
73	**Chrysocolla**	3	greasy to vitreous	green, blue green, blue.	impur to bla white
74	**SPHALERITE** (Blende)	3·75	resinous to adamantine	brown, yellow, black, red, green	reddi
75	**GOETHITE**	5·25	imperfect adamantine	yellow, reddish and blackish brown	brow low, yello
76	**LIMONITE**	5·25	greasy to glassy	dark brown to brownish yellow	yello
77	**Wolframite**	5·25		grayish or brownish black	dark brow
78	**Siphylite**	5·75	resinous, pseudometallic	dark brown to red	cinn brow gray
79	**Psilomelane**	5·75		steel-gray to iron-black	brow
80	**Rutile**	6·25	metallic adamantine	reddish brown to red, yellow, blue, violet, black, rarely grass green.	pale
81	**Cassiterite**	6·5	adamantine	brown or black, red gray, white or yel	whi lish,

II. Brownish Streak.

Color.	Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
yellowish green, brown and black	yellow brown to black		amorph.		Sometimes greenish by transmitted light.
liver-brown	brownish	slightly brittle	amorph.		Combustible.
brown to black.	brownish bl'k	slightly brittle	amorph.	uneven	G. 7·1. Combustible.
green, blue green, blue.	impure brown to black, pure white	brittle	amorph.	conch., sectile	G. 2.
brown, yellow, black, red, green	reddish br'wn	brittle	iso.	conch.	G. 3·9.
yellow, reddish and blackish brown	brownish yellow, ochre yellow	brittle	ortho.		
dark brown to brownish yellow	yellowish br'n	brittle	amorph.		G. 3·6.
grayish or brownish black	dark red brown to bl'ck	brittle	ortho.		G. 7·1–7·35. Sometimes weak magnetic.
dark brown to red	cinnamon-brown to pale gray	very brittle	ortho.	uneven conch.	4·89. Heated, glows brilliantly and becomes yellow.
steel-gray to iron-black	brownish bl'k	brittle	amorph.		G. 3·7–4·7.
reddish brown to red, yellow, blue, violet, black, rarely grass green.	pale brown	brittle	tetr.	sub-conch., uneven	G. 4·18–4·20.
brown or black, red, gray, white or yel'	white, grayish, brownish	brittle	tetr.	sub-conch., uneven.	G. 6·7–7·1.

III.

No.	Name.	Hardness.	Lustre.	Color.
82	**Erythrite**	1·75	pearly adamantine	crimson, peach-red, pearl, green gray
83	**CINNABAR**	2·25	adamantine	cochineal-red
84	**Proustite**	2·25	adamantine	cochineal-red
85	**Pyrargyrite**	2·25	metallic adamantine	black to cochineal-red
86	**Chrysocolla**	3	greasy to vitreous	green, blue green, blue
87	**CUPRITE**	3·5	adamantine	various shades of red
88	**Zincite**	4·25	sub-adamantine	deep red
89	**HEMATITE**	5·5	metallic to earthy	dark steel-gray to iron-black.

III.

Color.
crimson, peach-red, pearl, green gray
cochineal-red
cochineal-red
black to cochineal-red
green, blue green, blue
various shades of red
deep red
dark steel-gray to iron-black.

Reddish Streak.

Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
(paler than color)	laminæ flexible	mono.	sectile	G. 2·9.
scarlet		rhomb.	sectile	G. 8·9.
cochineal-red		rhomb.	uneven	G. 5·4.
cochineal-red		rhomb.	conch.	G. 5·7.
impure brownish to black, pure white	brittle	amorph.	conch., sectile	G. 2.
several shades of brownish red shining	brittle	iso.	sub-conch. uneven	G. 5·9.
orange-yellow to yellow red	brittle	hex.	sub-conch.	G. 5.
cherry red, reddish brown	brittle	rhomb.	sub-conch. uneven	G. 4·5–5·3. Sometimes magnetic.

IV. Yellowish

No.	Name.	Hardness.	Lustre.	Color.
90	**Orpiment**	1·5	pearly, resinous	lemon-yellow
91	**NATIVE SULPHUR**	1·75	resinous	sulphur-yellow
92	**Autunite**	2·25	sub-adamantine	citron to sulphur-yellow
93	**SPHALERITE** (Blende)	3·75	resinous to adamantine	brown, yellow, black, red, green
94	**Palagonite**	4·5	vitreous or greasy	amber-yellow, brown yellow, garnet-red, black
95	**Limonite**	5·25	silky to dull earthy	various browns to yellow
96	**Göthite**	5·25	imperfect adamantine	yellowish, reddish, blackish brown
97	**Cassiterite**	6·5	adamantine when in crystals.	brown, black, red, gray, whitish yellow

Yellowish

Color.
mon-yellow
lphur-yellow
tron to sulphur-ellow
rown, yellow, lack, red, green
mber-yellow, rown yellow, arnet-red, black
arious browns o yellow
yellowish, reddish, blackish brown
brown, black, red, gray, whitish yellow

Streak.

Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
(paler than color)	laminæ flexible	ortho.	sub-sectile	G. 3·4. Electric.
yellow, reddish, greenish		ortho.	sectile	G. 2.
yellowish		ortho.		G. 3.
reddish br'wn	brittle	iso.	conch.	G. 3·9 to 4·2. Electric.
yellow, brown yellow	brittle	amorph.		opaque.
yellow brown	brittle	compact fibrous and amorph.		G. 3·6. Often stalactitic.
brownish yellow, ochre-yellow	brittle	ortho.		G. 4.
white, grayish brown, yellowish	brittle	tetr.	sub-conch., uneven	G. 6·4 to 7.8. Botryoidal and reniform.

V. Green

No.	Name.	Hardness.	Lustre.	Color.
98	**Glauconite**	2	dull to glistening	blackish green, olive green, yellow green, gray green
99	**Johannite**	2·25	vitreous	emerald-green, apple-green
100	**ANNABERGITE**	2·25		apple-green
101	**Muscovite**	2·25	more or less pearly	white, gray brown, pale green, violet, yellow, green, rose-red.
102	**Thuringite**	2·5	of scales, pearly; of mass, dull, greasy	olive-green, pistachio-green
103	**Stilpnomelane**	3·4	vitreous	black, green black, yellow bronze, green bronze
104	**Genthite**	3·5		pale apple-green, yellowish
105	**Malachite**	3·75	adamantine, vitreous	bright green
106	**Pseudo-Malachite**	4·75	adamantine to vitreous	dark emerald, blackish green
107	**Uraninite**	5·5	greasy, pitch-like	greenish, velvet-bl'k

V. Green Streak.

Color.	Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
ackish green, olive een, yellow green, ay green	(same)		amorph.		G. 2 to 2·4. Granular.
nerald-green, pple-green	(paler than color)		mono.		G. 3. Bitter taste.
pple-green	gr'nish white	soft	monocl.	uneven	
hite, gray brown, ale green, violet, ellow, green, rose-ed.	colorless and light green		mono.		G. 2·7. Usually in scales.
live-green, pista-hio-green	(paler than color)	very tough	amorph.		G. 3·15.
lack, green black, ellow bronze, reen bronze	(same)		hex.		G. 3. Foliated or fibrous.
ale apple-green, ellowish	gr'nish white	fragile	amorph.	falls to pieces in water	G. 2·7.
bright green	paler green		monocl.	uneven	G. 3·5. Colors flame green.
dark emerald, blackish green	green (paler than color)	brittle	ortho.	uneven	G. 4·3.
greenish, velvet-bl'k	olive-green, bla'k, grayish		iso.	uneven	G. 6·4. Infusible.

6. Blue

No.	Name.	Hardness.	Lustre.	Color.
108	**Vivianite**	1·5	pearly to vitreous	white, dirty blue
109	**Chrysocolla**	3	vitreous, earthy	mountain-green to sky-blue
110	**AZURITE**	3·5	vitreous adamantine	azure-blue, Berlin-blue
111	**LAPIS LAZULI**	5	vitreous	Berlin or azure-blue, violet-blue, red, green

Streak.

Streak.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
blue white, indigo-blue	laminæ flexible	mono.	sectile dichroic	G. 2·7.
blue, pure white	sometimes brittle	(amorp.)	sectile, conch.	G. 2. Never fibrous.
(lighter than color)	brittle	mono.	conch.	G. 3·5. Often earthy.
		iso.	uneven	G. 2·3.

III. MINERALS OF WHITE

I. Very

No.	Name.	Hardness.	Lustre.	Color.
112	**Leidyite**	?	waxy, silky	green, bluish green
113	**Smectite**	very soft.	dull, streak shining	white, gray, green, brownish
114	**Talc**	1	pearly	apple-green to white, silver-white
115	**Tschermigite** (Ammonia Alum)	1	vitreous	white
116	**CERARGYRITE**	1·2	resinous to adamantine	pearl-gray, gray, green, whitish
117	**Pyrophyllite**	1·5	pearly	white, green, gray, yellowish
118	**JEFFERISITE**	1·5	pearly	brown, yellow
119	**ALUNOGEN**	1·5	vitreous, silky	white tinged with red or yellow

VHITE

I. Very

Color.
bluish green
gray, green, ish
green to silver-white
gray, gray, whitish
green, gray, vish
n, yellow
tinged with r yellow

OR GRAY STREAK.

Soft.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
	(amorp.) clay-like		greasy feel.
laminæ, flexible, not elastic	ortho.	very sectile	G. 2·5. Sub-transparent.
	iso.		soluble.
	iso.	sectile	G. 5·5. Streak silvery shining.
laminæ, flexible, not elastic	ortho.		G. 2·7. Greasy feel.
micaceous	ortho. (?)		G. 2·3. Exfoliates prodigeously.
(sub-transparent)	monocl.		G. 1·6. Tastes like common alum.

No.	Name.	Hardness.	Lustre.	Color.
120	**Arsenolite**	1·5	vitreous, silky	white, pale yellow
121	**Kaolinite**	1·75	pearly	white, gray-white, yellowish
122	**Sal Ammoniac**	1·75	vitreous	white, yellowish, grayish
123	**Mirabilite**	1·75	vitreous	white
124	**GYPSUM**	1·75	pearly, shining, sub-vitreous	white, gray, flesh-red, honey-yellow, ochre-yellow, blue black, brown, red
125	**Muscovite**	2	pearly	white, gray, brown, pale green, violet, yellow, (rose red)
126	**NITRE**	2	vitreous	white
127	**Halotrichite**	2	silky	yellow white
128	**Goslarite**	2	vitreous	white, bluish reddish
129	**EPSOMITE** (Epsom salt)	2	vitreous	white

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
	iso.		G. 3·6. Botryoidal or stalactitic.
scales are flexible, inclastic	ortho.		G. 2·4 to 2·6. Transparent to translucent.
soluble	iso.	fibrous, tough	G. 1·5. Taste saline, pungent.
	monocl.	(transparent) (opaque)	G. 1·4. Taste cool, then feebly saline and bitter
	monocl.	very distinct	G. 2·3. Transparent to opaque.
(laminæ, flexible, very tough)	ortho.	(easily split into laminæ)	G. 2·7. Transparent to translucent.
brittle	ortho.	(sub-transparent)	G. 1·9. Taste saline and cooling.
pulverulent on exposure		fibrous	Taste inky, astringent.
brittle	ortho.		G. 2. Taste metallic, astringent, nauseous.
			G. 1·7. Bitter saline.

No.	Name.	Hardness.	Lustre.	Color.
130	**Kalinite** (Potash alum)	2·2	vitreous	white
131	**Sepiolite** (Meerschaum)	2·25	(smooth feel or clay-like)	gray, white, yellow or red tinge
132	**Borax**	2·25	vitreous, resinous	white, grayish, bluish
133	**Cerolite**	2·25	resinous	greenish, yellowish, reddish, white
134	**Penninite**	2·25	pearly, vitreous	green less common, red, yellow and white
135	**Succinite** (Amber)	2·25	vitreous, resinous	yellow, red, brown, whitish
136	**Hydrozincite**	2·25	dull	white, gray, yellow
137	**Brucite**	2·5	pearly, waxy and vitreous	white, gray, blue, green
138	**BIOTITE**	2·5	splendent, pearly	green to black, rarely white
139	**Halite** (Common salt)	2·5	vitreous	white, yellowish, reddish, bluish

Color.
white
gray, white, yellow or red tinge
white, grayish, bluish
greenish, yellowish, reddish, white
green less common, red, yellow and white
yellow, red, brown, whitish
white, gray, yellow
white, gray, blue, green
green to black, rarely white
white, yellowish, reddish, bluish

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
	iso.		G. 1·7. Infusible, decrepitates.
(opaque)	(compact)		in dry masses, floats on water.
brittle	monocl.	conch.	G. 1·7. Taste sweet alkaline.
(feels greasy)	(amorph.)	conch.	G. 2·3. Does not adhere to tongue.
laminæ flexible, not elastic	rhom.	perfect basal	G. 2·6 to 2·85. Pseudomorphs after hornblende occur.
(transparent)	(amorph.)	sub-ch.	G. 1. Electric on friction.
(earthy, chalk-like)	(amorph.)		G. 3·5 to 3·8.
laminæ flexible	rhom.	(sectile)	G. 2·3.
elastic	hex.	perfect	G. 2·7 to 3·1.
brittle	iso.		G. 2·1. Decrepitates.

No.	Name.	Hardness.	Lustre.	Color.
140	**PHLOGOPITE**	2·5	pearly, sub-metallic	yellow, brown, br'n red, green, white
141	**Glauberite**	2·5	vitreous	yellow, gray
142	**Caledonite**	2·5	resinous	green, blue green
143	**Deweylite**	3	resinous	white, yellow, greenish, reddish
144	**Lepidolite**	3	pearly	rose-red, yellow, violet-gray, white
145	**Chrysocolla**	3	vitreous, also earthy	green to blue

II.

No.	Name.	Hardness.	Lustre.	Color.
146	**Serpentine**	2·5 to 4	greasy	green, red, yellow
147	**WULFENITE**	2·75	resinous, adamantine	yellow, green, brown, red
148	**Anglesite**	2.75	adamantine, resinous, vitreous	
149	**CALCITE**	3	vitreous to earthy	white, gray, red, green, blue, violet, yellow

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
laminæ tough, elastic	ortho.		G. 2·8. Sometimes reflects light, copper-like.
brittle	monocl.	conch.	G. 2·6. Saline taste.
rather brittle	ortho.	uneven	G. 6·4. Translucent.
very brittle	amorp.		G. 1·9 to 2·2. Looks like gum arabic or resin.
	ortho.		G. 2·8. Colors flame crimson.
brittle	cryptocrys.	sectile	G. 2. Botryoidal and massive.

Soft.

Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
	ortho.	splintery conch.	G. 2·5. Often unctuous.
brittle	tetr.	sub-conch.	G. 6. Translucent.
very brittle	ortho.	conch.	G. 6·1. B. B. yields lead.
brittle	rhomb.	conch.	G. 2·5. Effervesces with acids.

No.	Name.	Hardness.	Lustre.	Color.
150	**ANHYDRITE**	3	vitreous to pearly	white to brick-red
151	**CELESTITE**	3	vitreous	white, faint blue, reddish
152	**BARITE**	3	vitreous	white, tinted often
153	**Allophane**	3	vitreous to sub-resinous	blue, green, yellow, brown
154	**Stilpnomelane**	3	pearly or vitreous	black, yellow, green
155	**CERUSSITE**	3·25	adamantine, vitreous, resinous	white, gray, gray black
156	**PYROMORPHITE**	3·5	resinous	green, yellow, br'wn
157	**Laumontite**	3·5	vitreous	white to yellow, gray
158	**Stilbite**	3·5	vitreous	white, yellow, brown, red

Color.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
ite to brick-red		ortho.	uneven	G. 2·8. Heated, gives no water.
ite, faint blue, ddish	very brittle	ortho.	conch., uneven	G. 3·9. B. B. crimson color.
hite, tinted often		ortho.		G. 4·3. Sometimes fetid when rubbed.
ue, green, yellow, rown	very brittle	amorp.	conch., shining	G. 1·8. Translucent.
lack, yellow, green		cryst.		G. 3. Foliated or velvety.
hite, gray, gray lack	very brittle	ortho.	conch.	G. 6·4 Translucent.
reen, yellow, br'wn	brittle	hex.	uneven	G. 6·5. Decrepitates sometimes.
white to yellow, ray	not very brittle	mono.	uneven	G. 2·2 to 2·4. Readily crumbles.
white, yellow, rown, red	brittle	ortho.	uneven	G. 2. Translucent.

No.	Name.	Hardness.	Lustre.	Color.
159	**Scorodite**	3·5	vitreous, sub-adamantine, sub-resinous	pale leek-green, liver-brown
160	**Strontianite**	3·5	vitreous	green, white, gray, yellow
161	**Witherite**	3·5	vitreous	white, yellow, gray
162	**ARAGONITE**	3·5	vitreous	white, gray, yellow, green, violet
163	**SPAHLERITE** (Elende)	3·5	resinous, adamantine	brown, yellow, bl'k, red, green, white
164	**DOLOMITE**	3·5 to 4	vitreous	white, red, green, brown, gray, black
165	**FLUORITE**	4	vitreous; sometimes splendent	white, yellow, gre'n, rose, blue, brown
166	**Siderite**	4	vitreous	ash-gray, yellow gray, brown, green, white
167	**Triphylite**	5	sub-resinous	green, gray, bluish

Color.	Tenacity.	Crystalline System.	Fracture and Cleavage.	Remarks.
pale leek-green, liver-brown		ortho.	uneven	G. 3. Sub-transparent.
green, white, gray, yellow	brittle	ortho.	uneven	G. 3·6. Colors flame crimson.
white, yellow, gray	brittle	ortho.	uneven	G. 4·2. Sub-transparent.
white, gray, yellow, green, violet	brittle	ortho.	sub-conch.	G. 2·9. Often in compound crystals.
brown, yellow, bl'k, red, green, white	brittle	iso.	conch.	G. 3·9 to 4·2. Transparent to sub-translucent.
white, red, green, brown, gray, black	brittle	rhomb.		G. 2·8. Translucent, rarely transparent.
white, yellow, gre'n, rose, blue, brown	brittle	iso.	conch. and splintery	G. 3 to 3·25. Phosphoresces when heated.
ash-gray, yellow gray, brown, green, white	brittle	rhomb.	uneven	G. 3·7. Heated, becomes magnet'
green, gray, bluish	brittle	ortho		G. 3·5. Colors flame red.

III. Medium Hardness,

No.	Name.	Hardness.	Lustre.	Color.
168	**Margarite**	4	pearly, vitreous	gray, yellowish, reddish white
169	**Magnesite**	4	vitreous	white, yellowish, gray white, brown
170	**Chabazite**	4·5	vitreous	white, flesh red
171	**Apophyllite**	4·5	vitreous	white, grayish
172	**Wollastonite**	4·75	vitreous	white to gray, yellow, red, brown
173	**CALAMINE**	4·75	vitreous, adamantine	white, yellow to brown
174	**Mordenite**	5	highly silky	white, yellowish
175	**APATITE**	5	vitreous to subresinous	green, blue, white, yellow
176	**Cœruleolactite**	5	vitreous	blue, greenish blue
177	**SMITHSONITE**	5	vitreous	white, gray, green, brown
178	**Datolite**	5·25	vitreous	gray, green, yellow, red.
179	**Enstatite**	5·5	pearly to vitreous	gray white, green white
180	**Pyroxene**	5·5	vitreous	green to white, green to black

White Streak.

Crystalline System.	Fracture and Cleavage.	Remarks.
ortho.		G. 2·9. Laminæ brittle.
rhomb.	conch.	G. 3. Opaque, transparent.
rhomb.	uneven	G. 2. Brittle.
tetr.		G. 2·3. Brittle, transparent.
mono.	uneven; sometimes very tough	G. 2·7. Fibrous structure.
ortho.	uneven	G. 3·1. Brittle.
	brittle	G. 2. Concretionary.
hex.	uneven	G. 2·9. Transparent, brittle.
crypto-crystalline.	uneven to conchoidal	G. 2·55 to 2·6.
rhomb.	uneven.	G. 4. Brittle.
mono.	uneven	G. 2·8. Brittle.
ortho.		G. 3·1.
mono.	uneven	G. 3·2. Brittle.

IV. Hard.

No.	Name.	Hardness.	Lustre.	Color.
181	**ANDALUSITE**	3–7	vitreous	whitish, red, gray, green
182	**Natrolite**	5·5	vitreous	white, grayish, yellow, red
183	**Ekebergite**	5·5	vitreous, pearly, greasy	white, gray, bluish, reddish
184	**LAZULITE**	5·5	vitreous	azure-blue, greenish blue
185	**WILLEMITE**	5·5	vitreous to resinous	white, yellow, green. brown
186	**Thomsonite**	5·5	vitreous	snow-white, brown
187	**Analcite**	5·5	vitreous	white, gray, green, yellow
188	**Brookite**	5·5	metallic, adamantine	hair-brown, yellowish
189	**Enstatite**	5·5	pearly, vitreous, metalloidal	gray yellow, green white
190	**TITANITE**	5·5	adamantine, resinous	brown, gray, black, yellow, green
191	**PYROXENE**	5·5	vitreous, resinous	green to white, green to black

IV. Hard.

	Color.
	whitish, red, gray, green
	white, grayish, yellow, red
	white, gray, bluish, reddish
	azure-blue, greenish blue
ous	white, yellow, green. brown
	snow-white, brown
	white, gray, green, yellow
	hair-brown, yellowish
,	gray yellow, green white
	brown, gray, black, yellow, green
ous	green to white, green to black

White Streak.

Crystalline System.	Fracture and Cleavage.	Remarks.
ortho.	uneven	G. 3. Having cross in transverse section.
ortho.		G. 2·1. Transparent.
tetr.		G. 2·7. Resembles Wernerite.
mono.	uneven	G. 3. Sub-transparent, brittle.
rhomb.	conch.	G. 3·8. Transparent, brittle.
ortho.	uneven	G. 2·3. Pyro-electric, brittle.
iso.	sub-conch.	G. 2·2. Brittle.
ortho.		G. 4·1. Brittle.
ortho	prismatic, fibrous	G. 3·1. Resembles amphibole and pyroxene.
mono.	brittle	G. 3·4. Transparent, opaque.
mono.	conch., uneven	G. 3·2. Brittle.

No.	Name.	Hardness.	Lustre.	Color.
192	**AMPHIBOLE**	5·5	vitreous; often silky	white to black, through green
193	**Hypersthene**	5·5	pearly; sometimes metalloidal	brown, green, gray black, pinchbeck brown
194	**Octahedrite**	5·5	metallic, adamantine	brown to blue, black
195	**Cyanite**	5–7	vitreous	blue, white, gray, green, black
196	**OPAL**	6	vitreous, pearly	white, yellow, red, brown, green
197	**Amblygonite**	6	vitreous to greasy	sea-green, white, brownish
198	**Sodalite**	6	vitreous, greasy	gray, blue, brown
199	**Rhodonite**	6	vitreous	brownish red greenish, yellowish
200	**Chloritoid**	6	pearly	gray, green gray, green black
201	**Turquois**	6	waxy, feeble	sky-blue, blue green, apple-green
202	**ZOISITE**	6	pearly	white, gray, yellow, brown

Color.
white to black, through green
brown, green, gray black, pinchbeck brown
brown to blue, black
blue, white, gray, green, black
white, yellow, red, brown, green
sea-green, white, brownish
gray, blue, brown
brownish red greenish, yellowish
gray, green gray, green black
sky-blue, blue green, apple-green
white, gray, yellow, brown

Crystalline System.	Fracture and Cleavage.	Remarks.
mono.	sub-conch., uneven	G. 2·9. Frequently columnar, also fibrous.
ortho.		G. 3·3. Resembles enstatite.
tetr.	sub-conch.	G. 3·8. Brittle.
tricl.		G. 3·4. Crystals, blue centers white margins.
amorp.		G. 1·9. Sometimes rich play of colors by reflected light.
tricl.	uneven	G. 3. Translucent.
iso.	uneven	G. 2·3. Decomposed by HCl.
tric.	conch., uneven	G. 3·4. Tough.
mono., tri.	brittle	G. 3·5. Strongly dichroic.
reniform, massive	conch.	G. 2·6. False turquois is softer.
ortho.		G. 3·1. Transparent, translucent.

No.	Name.	Hardness.	Lustre.	Color.
203	**LABRADORITE**	6	vitreous, sub-resinous	gray, brown, green
204	**ORTHOCLASE**	6	vitreous	white, gray, green
205	**ALBITE**	6	vitreous	white; sometimes blue, gray, green
206	**OLIGOCLASE**	6	waxy to vitreous	white to grayish, reddish
207	**DIASPORE**	6·5	vitreous	white, brown, yellow
208	**SPODUMENE**	6·5	pearly	gray green

V. Very Hard.

No.	Name.	Hardness.	Lustre.	Color.
209	**Allanite**	6	sub.metallic, pitchy	brown to black
210	**PREHNITE**	6·5	vitreous	light green to gray
211	**EPIDOTE**	6·5	vitreous, resinous	green to black

	Color.
	gray, brown, green
	white, gray, green
	white; sometimes blue, gray, green
ous	white to grayish, reddish
	white, brown, yellow
	gray green

V. Very Hard.

	Color.
	brown to black
	light green to gray
nous	green to black

Crystalline System.	Fracture and Cleavage.	Remarks.
tric.		G. 2·6. Translucent.
mono.	right angled and conch. to uneven	G. 2·4. Transparent to translucent.
tric.	uneven	G. 2·5. Both have striated surfaces.
tric.	conch. to uneven	G. 2·5.
ortho.	very brittle	G. 3·3. When thin, translucent.
mono.	uneven	G. 3·1. Translucent.

White Streak.

Crystalline System.	Fracture and Cleavage.	Remarks.
mono.	uneven	G. 3. Opaque, brittle.
ortho.	uneven	G. 2·8. Pyro-electric.
mono.	uneven	G. 3·2. Brittle.

No.	Name.	Hardness.	Lustre.	Color.
212	**CHALCEDONY**	6·5	waxy	white, gray, brown, blue
213	**CHRONDRODITE**	6·5	vitreous, resinous	white, yellow, brown,
214	**RUTILE**	6·5	metallic, adamantine	red, brown
215	**CASSITERITE**	6·5	adamantine	brown, black
216	**Fibrolite**	6·5	vitreous to sub-adamantine	brown, white, green
217	**CHRYSOLITE**	6·5	vitreous	green
218	**Vesuvianite**	6·5	vitreous	brown, green, yellow, blue
219	**QUARTZ**	7	vitreous	colorless, many shades
220	**GARNET**	7	vitreous, resinous	red, brown, yellow, green, black
221	**Axinite**	7	highly glassy	brown, blue, gray
222	**TOURMALINE**	7	vitreous	black, (blue, red, green)

Color.	Crystalline System.	Fracture and Cleavage.	Remarks.
white, gray, brown, blue	crypto-cryst.		Transparent, translucent.
white, yellow, brown,	ortho.	sub-conch. uneven	G. 3·1. Transparent, sub-transparent.
red, brown	tetr.	uneven	G. 4·1. Brittle
brown, black	tetr.	sub-conch. uneven	G. 6·4. Brittle.
brown, white, green	mono.		G. 3·2. Transparent to translucent.
green	ortho.	conch.	G. 3·3. Transparent, translucent.
brown, green, yellow, blue	tetr.	sub-conch. uneven	G. 3·3. Streak uncolored, sometimes dichroic.
colorless, many shades	hex.	couch.	G. 2·5. Transparent, opaque, brittle.
red, brown, yellow, green, black	iso.	sub-conch. uneven	G. 3·1. Transparent, brittle.
brown, blue, gray	tric.	conch.	G. 3·2. Trichroic, brittle.
black, (blue, red, green)	hex.	uneven	G. 2·9. Pyroelectric, dichroic.

No.	Name.	Hardness.	Lustre.	Color.
223	**Iolite**	7·25	vitreous	blue
224	**Schorlomite**	7·25	vitreous	black
225	**ANDALUSITE**	7·5	vitreous	whitish, red, violet, green
226	**Staurolite**	7·5	sub-vitreous to resinous	reddish-brown, brown, black, yellow-brown
227	**Zircon**	7·5	adamantine	colorless, brown, yellow, gray
228	**BERYL**	7·75	vitreous, resinous	emerald-green, blue, yellow
229	**SPINEL**	8	vitreous	red, blue, green, yellow
230	**TOPAZ**	8	vitreous	yellow, white, green, blue
231	**CHRYSOBERYL**	8·5	vitreous	green
232	**CORUNDUM**	9	vitreous	blue, red, yellow, brown, gray
233	**DIAMOND**	10	brilliant, adamantine	white, colorless, tinged sometimes

Color.
blue
black
whitish, red, violet, green
reddish-brown, brown, black, yellow-brown
colorless, brown, yellow, gray
emerald-green, blue, yellow
red, blue, green, yellow
yellow, white, green, blue
green
blue, red, yellow, brown, gray
white, colorless, tinged sometimes

Crystalline System.	Fracture and Cleavage.	Remarks.
ortho.	sub-conch.	G. 2·5. Pleochroic.
amorph.	conch.	G. 3·8. Often irised, tarnished.
ortho.	sub-conch., uneven	G. 3. Sub-translucent.
ortho.	conch.	G. 3·4. Translucent.
tetr.	conch.	G. 4. Transparent, opaque.
hex.	conch., uneven	G. 2·6. Transparent, brittle.
iso.	conch.	G. 3·5. Transparent.
ortho.	conch., uneven	G. 2·4. Pyroelectric.
ortho.	conch., uneven	G. 3·6. Transparent.
rhom.	conch., uneven	G. 3·9. Very tough.
iso.	conch.	G. 3·52. Electric when rubbed.

SUPPLEMENTARY

MINERALS OF LOW LUSTRE

I. EASILY DISSOLVED IN

Name.	Hardness.	Taste.
Mirbalite (Glauber salt)	1·5	cool, then feebly saline and bitter.
Sal Ammoniac	1·5	saline, pungent (not deliquescent).
Nitre	2	saline, cooling.
Alunogen	2	like common alum.
Halotrichite	2	inky-astringent.
Borax	2·25	sweet-alkaline, feeble.

ENTARY
LUSTRE
DISSOLVED IN

Taste.
ly saline and bitter.
t (not deliquescent).
alum.
t.
, feeble.

TABLES.

AND COLORLESS STREAK.

WATER OR VINEGAR.

Name.	Hardness.	Taste.
Morenosite	2·5	metallic-astringent.
Goslarite	2·5	metallic-astringent, nauseous.
Epsomite (Epsom salt)	2·5	bitter, saline.
Kalinite	2·5	like common alum.
Halite (Salt)	2·5	purely saline.
Glauberite	2·75	slightly saline.

II. Not Soluble.

Name.	Hardness.	Fusibility.
Hydrozincite	2·5	infusible.
Caledonite	2·75	easily fusible.
Calcite	3	infusible.
Cerussite	3	on charcoal easily reduces to lead.
Witherite	3·75	easily fusible.
Strontianite	3·75	fusible with difficulty.

Effervescing with Acid.

Name.	Hardness.	Fusibility.
Aragonite	4	infusible.
Dolomite	4	infusible (effervesces sparingly).
Siderite	4	fusible with difficulty, dissolves in hot acid.
Magnesite	4·5	infusible.
Smithsonite	5	infusible.

III. Insoluble. Not

A. YIELDING WATER WHEN

PULVERIZED.	IN THE FLAME.	
	VOLATILE OR FUSIBLE.	
IN HOT OR COLD, DILUTE OR CONCENTRATED ACID.	NAME.	HARDNESS.
Completely and promptly dissolved		
Completely, not easily dissolved		
Completely and readily dissolved with separation of gelatinous silica	Apophyllite Natrolite	4·75 5·25
Completely and readily dissolved with separation of pulverulent or semi-gelatinous silica		
Dissolved with difficulty, silica separating out		
Only partially decomposed or dissolved		
Insoluble or but very slightly acted upon	Succinite	2·5

NOTE.—Minerals indicated by (A)

soluble. Not

WATER WHEN

IN THE FLAME.

OLATILE OR FUSIBLE.

NAME.	HARDNESS.
pphyllite	4·75
rolite	5·25
ccinite	2·5

—Minerals indicated by (A)

Effervescing with Acids.

HEATED IN CLOSED TUBE.

BEFORE THE BLOWPIPE.

FASILY FUSIBLE.		FUSIBLE WITH DIFFICULTY.		INFUSIBLE.	
NAME.	HARDNESS.	NAME.	HARDNESS.	NAME.	HARDNESS.
Annabergite	2·25			Brucite	2·5
Scorodite	3·5			Wavellite	3·5
Gypsum	2			Diaspore	6·5
Laumontite	3·5			Chrosocolla	3
Datolite	5			Allophane	3·25
Thomsonite	5·25			Calamine	4·75
Allanite	6				
Stilbite	3·75				
Chabazite	4·5	Deweylite	2·5	Hydrophite	2.5
Smectite	1·25	Serpentine	3	Serpentine	3
				Kaolinite	1
Prehnite (A)	6·5	Stilpnomelane	3·5	Pyrophyllite (A)	1·5
		Bastite	3·75	Hallyosite	2
				Lazulite (A)	5·5
		Agalmatolite	2·5	Cerolite	2·25
Carpholite (A)	5	Ripidolite	2·25	Carnat	2·5
		Picrolite	4	Turquois	6
		Chloritoid	5·75		

exfoliate, swell up or gelatinize.

B. YIELDING LITTLE OR NO WATER

Pulverized.	In the Flame.	
	Volatile or Fusible.	
In Hot or Cold, Dilute or Concentrated Acid.	Name.	Hardness.
Completely and easily soluble	Arsenelite	1·5
Completely but with difficulty soluble	Amblygonite	6
Readily dissolved with separation of gelatinous silica		
Readily dissolved with separation of pulverulent silica, lead chloride or tungstic acid		
Insoluble or but slightly acted upon	Cerargyrite	1
	Lepidolite	2.5

WHEN HEATED IN CLOSED TUBE.

Before the Blowpipe.

Easily Fusible.		Fusible with Difficulty.		Infusible.	
Name.	Hardness.	Name.	Hardness.	Name.	Hardness
Tryphylite	5	Apatite	5		
Fluorite	4				
		Wallastonite	4·5	Willemite	5·5
Sodalite (A)	5·5	Allanite	6 5	Chondrodite	6 5
Allanite	6·5	Chrysolite	6·5	Chrysolite	6·5
Wulfenite	3				
Stolzite	3	Scheelite	4·5		
Ekebergite	6				
Muscovite	2.5				
Anhydrite	3			Brookite	5·5
Anglesite	3			Chiastolite	5·5
Celestite	3			Cyanite	5–6
Pyromorphite	3.5	Talc	1	Opal	5 25
Mimetite	3·5	Barite	3	Octahedrite	5 5
Rhodonite	5·5	Sphalerite	4	Enstatite	5·5
Pyroxene (A)	5·5	Margarite	4	Rutile	6
Tremolite	5·5	Titanite		Cassiterite	6·5
Fassaite	6	Zoisite	6	Fibrolite	6·5
Oligoclase	6.5	Orthoclase	6	Quartz	7
Labradorite	6	Albite (A)	6·5	Chalcedony	7
Omphacite	6	Epidote (A)	6·5	Andalusite	7
Spodumene (A)	6·5	Tourmaline	7	Staurolite	7·5
Epidote (A)	6·5	Garnet	7	Zircon	7·5
Zoisite	6	Iolite	7	Chrysoberyl	8·5
Garnet	7	Beryl	7·5	Spinel	8
Vesuvianite	7			Topaz	8
Axinite (A)	7			Corundum	9
Tourmaline	7			Diamond	10
Schorlomite	7·5				

BLOW PIPE TESTS.

ORES OF GOLD.

Native Gold.—Combination of Au. and Ag. in variable proportions, sometimes with traces of Fe. and Cu. It usually occurs in variously contorted and branched filaments, in scales, in plates, or in small, irregular masses.

On Ch., fuses to a globule which after cooling has a bright metallic surface. With S. Ph. in O. Fl. a bead is formed which opalizes on cooling, or becomes opaque and yellow, according to the amount of silver which it contains.

Resists the action of heated concentrated nitric acid; soluble only in aqua regia.

Sylvanite [Graphic Tellurium].—$AgAuTe_3$.

In an open glass tube, yields a white sublimate which, when played upon with the flame, fuses to transparent drops. On Ch. fuses to a dark-gray globule, depositing at the same time a white Ct. which, when touched with the R. Fl., disappears, tinging the flame bluish-green. It finally affords a light-yellow malleable globule of metallic lustre.

Soluble in aqua regia, leaving a residue of chloride of silver. The solution gives a white precipitate with water.

ORES OF SILVER.

Native Silver.—Pure silver, associated with gold, copper, arsenic, iron, and other metals. Occurs usually in twisted filaments, or arborescent; sometimes in plates or massive.

On Ch., fuses easily to a globule, which assumes a bright surface, and shows after cooling a silver-white color. Foreign metals are detected by assaying in a cupel.

It dissolves in nitric acid.

Dyscrasite [Antimonial Silver].—Ag_3Sb. and Ag_2Sb. H = 3.5—4. G = 9.4—9.8.

On Ch., fuses readily to a gray non-ductile globule and coats the Ch. with oxide of antimony; with continued heat the globule assumes the appearance of pure silver, and the Ct. becomes reddish.

Dissolves in nitric acid, leaving a residue of oxide of antimony.

Cerargyrite [Horn Silver].—AgCl. 75.2 per cent. Ag. It turns brown on exposure to air. When rubbed with a moistened plate of zinc or iron the latter becomes covered with a coating of silver. The streak is shining.

It fuses in a candle-flame. On Ch., is easily reduced, especially when mixed with Sd. Mixed with oxide of copper and heated on Ch. in R. Fl., chloride of copper is formed, which colors the flame azure-blue.

Insoluble in water and nitric acid. Slowly soluble in caustic ammonia. Partially decomposed by a boiling solution of caustic potassa.

Argentite [Silver Glance].—AgS. 87.1 per cent. Ag. It is easily distinguished from other minerals of the same color by being cut by a knife like lead.

On Ch. in O. Fl., intumesces, gives out sulphurous acid, and finally yields a globule of metallic silver.

Soluble in dilute nitric acid, leaving a residue of sulphur.

Pyrargyrite [Dark-red Silver Ore].—$3AgS, SbS_3$. 59.9 per cent. Ag.

In a matrass, fuses very readily and yields with continued heat a sublimate of tersulphide of antimony. In an open glass tube, gives antimonial fumes and sulphurous acid. On Ch., fuses readily and deposits a Ct. of antimonous oxide, being converted into sulphide of silver; if for a long time exposed to the O. Fl., or, when mixed with Sd., in the R. Fl., affords a globule of metallic silver.

Part of the SbS_3 is sometimes substituted by AsS_3; it then gives out arsenical fumes when mixed with Sd. and heated in the R. Fl. on Ch.

The pulverized mineral, when heated with nitric acid, turns black, and is ultimately dissolved, leaving a residue of sulphur and antimonous acid. Caustic potassa also blackens it and effects partial solution, from which acids precipitate tersulphide of antimony.

Proustite [Light-red Silver Ore].—$3AgS, As_2S_3$. 65.4 per cent. Ag.

Before the Blp. and to solvents, behaves like the preceding, excepting it gives off arsenical fumes instead of antimonous oxide. The solution in caustic potassa deposits a yellow precipitate when neutralized with acids.

Stephanite [Brittle Silver Ore].—$5AgS, Sb_2S_3$. 68.5 per cent. Ag.

In a matrass, decrepitates, then fuses and ultimately yields a faint sublimate of tersulphide of antimony. On Ch., fuses very readily and coats the Ch. with antimonous acid. If the blast with the O. Fl. is kept up for a sufficient time, the Ct. assumes a red color and a globule of metallic silver is obtained. Contains frequently copper and iron, which may be detected by appropriate tests. If arsenic is present it gives in the open tube a crystalline sublimate of arsenious acid

In dilute heated nitric acid it dissolves, excepting the sulphur and antimonous oxide; the solution becomes milky on addition of water. Partially dissolved by a boiling solution of caustic potassa.

Polybasite.—$9(Ag, Cu_2)S + (Sb, As)_2S_3$.

In a matrass, fuses very readily, but gives nothing volatile. In an open tube, gives sulphurous acid and antimonial fumes; the sublimate contains sometimes crystals of arsenous acid. On Ch., gives a Ct. of oxide of antimony; with continued heat, gives a bright metallic globule, which, on cooling, becomes black on its surface; sometimes a faint Ct. of oxide of zinc is deposited; the metallic globule affords with fluxes the reaction of silver and copper.

Stromeyerite [Argentiferous Sulphide of Copper].—$Cu_2S + AgS$. 53 per cent. Ag, 31.2 per cent. Cu.

In a matrass, fuses easily and gives sometimes a little sulphur. In an open tube, fuses to a globule and gives sulphurous acid. On Ch., fuses to a gray metallic globule which is a little malleable; with fluxes the globule gives the reactions of copper, sometimes also those of iron; on a cupel with lead affords a globule of silver.

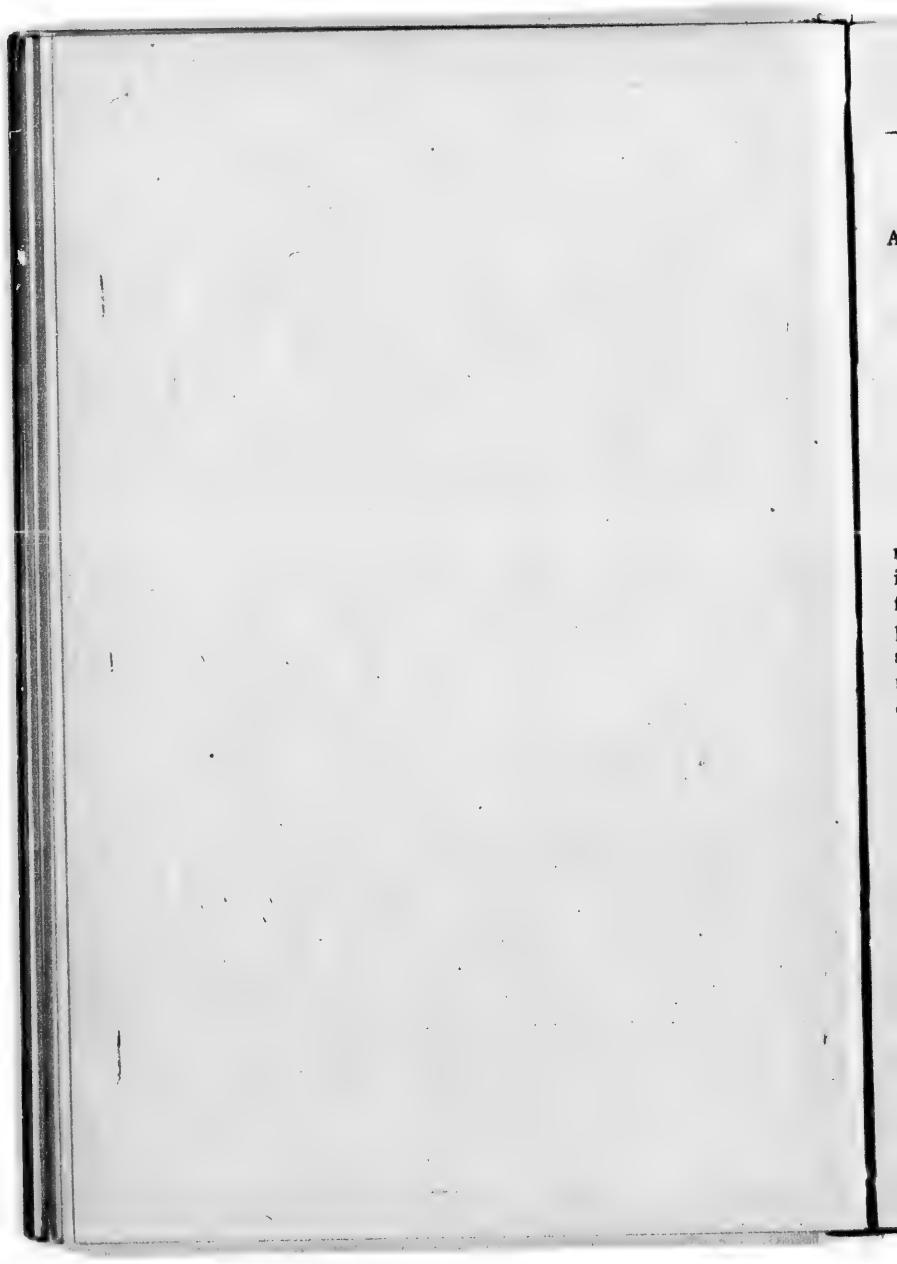
Dissolves in nitric acid, leaving a residue of sulphur.

BLOW PIPE ASSAY.

SILVER AND GOLD ORES.

The ore is reduced to a fine powder, mixed with vitrified borax and metallic lead (the quantities of which altogether depend upon the nature of the substance, and for which, therefore, no general rule can be given), and the mass placed in a cylindrical hole of the Ch. A powerful R. Fl. is given until the metals have united to a button, and the slag appears free from metallic globules. The flame is now converted into an O. Fl. and directed principally upon the button. Sulphur, arsenic, antimony, and other very volatile substances, are volatilized; iron, tin, cobalt, and a little copper and nickel become oxidized and are absorbed by the flux; silver and gold and the greater part of the copper and nickel remain with the lead (and bismuth, if present). When all volatile substances are driven off, the lead begins to become oxidized and the button assumes a rotary motion; at this period the blast is discontinued, the assay is allowed to cool, and when perfectly cold the lead button is separated from the glass by some slight strokes with a hammer. It is now placed on a cupel of bone-ash and treated with the O. Fl. until it again assumes a rotary motion. If much copper or nickel is present, the globule becomes covered with a thick infusible crust, which prevents the aimed-at oxidation; in this case another small piece of pure lead has to be added. The blast is kept up until the whole of the lead and other foreign metals, viz., copper and nickel, are oxidized; this is indicated by the cessation of the rotary movement, if only little silver is present, or by the appearance of all the tints of the rainbow over the whole surface of the button, if the ore was very rich in silver; after a few moments it takes the look of pure silver. The oxides of lead, copper, etc., are absorbed by the bone-ash, and pure silver, or an alloy of silver, with other noble metals, remains behind; the button may be tested for gold by dissolving in nitric acid.

The chloride of silver can be reduced on coal with soda to metallic silver.



THE SCALE OF HARDNESS,

As introduced by Mohs, and enlarged by Breithaupt, is as follows:

1. Talc; common laminated light-green variety.
2. Gypsum; crystalline variety.
3. Calcite; transparent variety.
4. Fluorite; crystalline variety.
5. Apatite; transparent variety.
6. Orthoclase; white cleavable variety.
7. Quartz; transparent.
8. Topaz; transparent.
9. Corundum; cleavable varieties.
10. Diamond.

To test the hardness of a mineral we may proceed in two different manners; firstly, by attempting to scratch it with the minerals enumerated in the scale, successively; or, secondly, by abrasion with a file. If the file abrades the mineral under trial with the same ease as No. 4, and produces an equal depth of abrasion with the same force, its hardness is said to be 4. If with more facility than 4, but less than 5, the hardness may be 4.2 or 4.5. Several successive trials should be made to obtain certain results; and, when practicable, both methods should be employed.

A set of minerals, representing the scale of hardness, being not always at hand, it will be useful to give a series of substitutes for them, as arranged by Mr. Chapman:

1. Yields easily to the nail.

2. Yields with difficulty to the nail, or merely receives an impression from it. Does not scratch a copper coin.

3. Scratches a copper coin; but is also scratched by it, being of about the same degree of hardness.

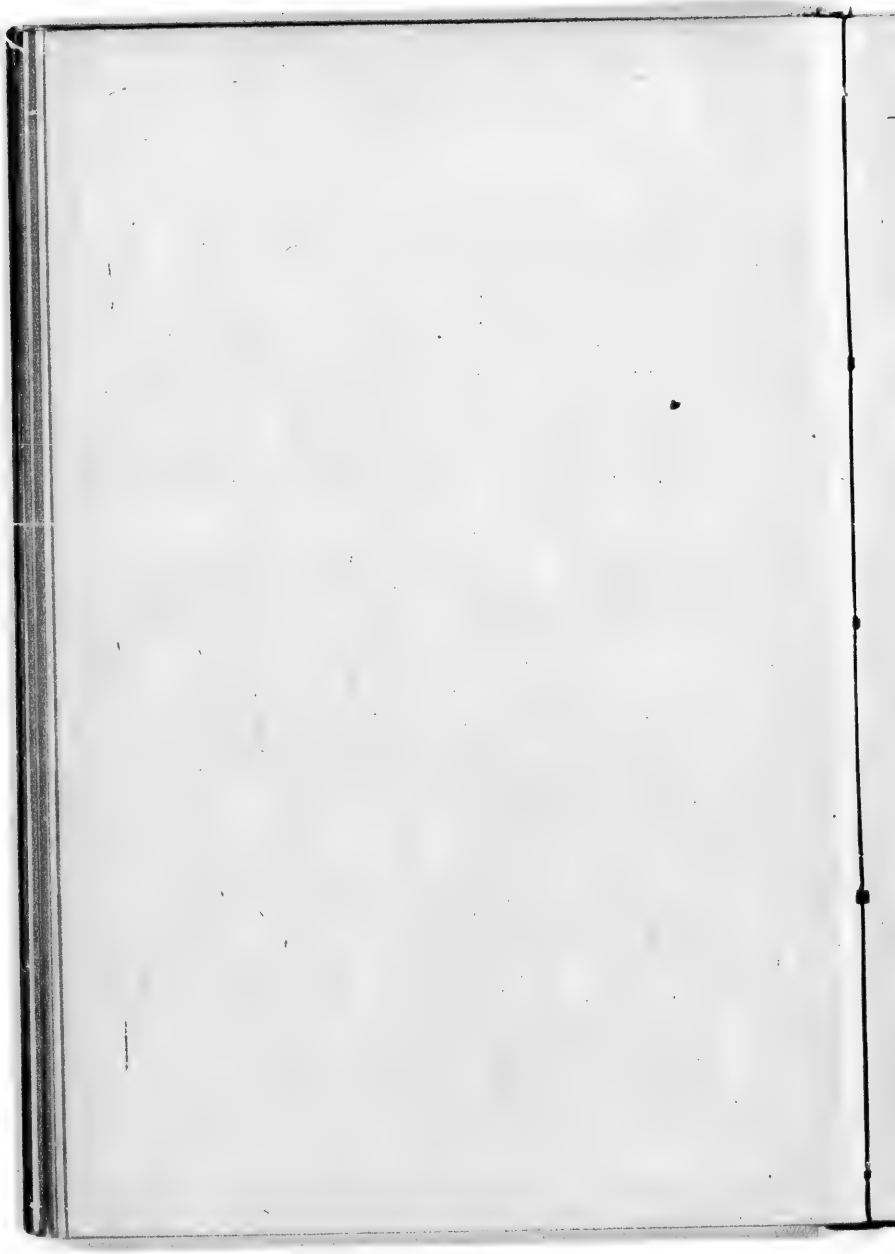
4. Not scratched by a copper coin; does not scratch glass.

5. Scratches glass, though with difficulty, leaving its powder upon it. Yields readily to the knife.

6. Scratches glass easily. Yields with difficulty to the knife.

7. Does not yield to the knife. Yields to the edge of a file, though with difficulty.

8, 9, 10. Harder than flint.



ABBREVIATIONS.

iso.—isometric.
tetr.—tetragonal.
mono.—monoclinic.
ortho.—orthorhombic.
rh.—rhomboidal.
hex.—hexagonal.
cryst.—crystalline.
amorph.—amorphous.
G.—Specific Gravity.
prism.—prismatic.
conch.—conchoidal.
tricl.—triclinic.
Ch.—Charcoal.
O. Fl.—Oxidizing Flame.
R. Fl.—Reducing Flame.
Ct.—Coating.
Sd.—Carbonate of Soda.
S. Ph.—Salt of Phosphorus.
Blp.—Blow Pipe.

SYNOPSIS OF ARRANGEMENT.

Minerals of Metallic Lustre..... 7
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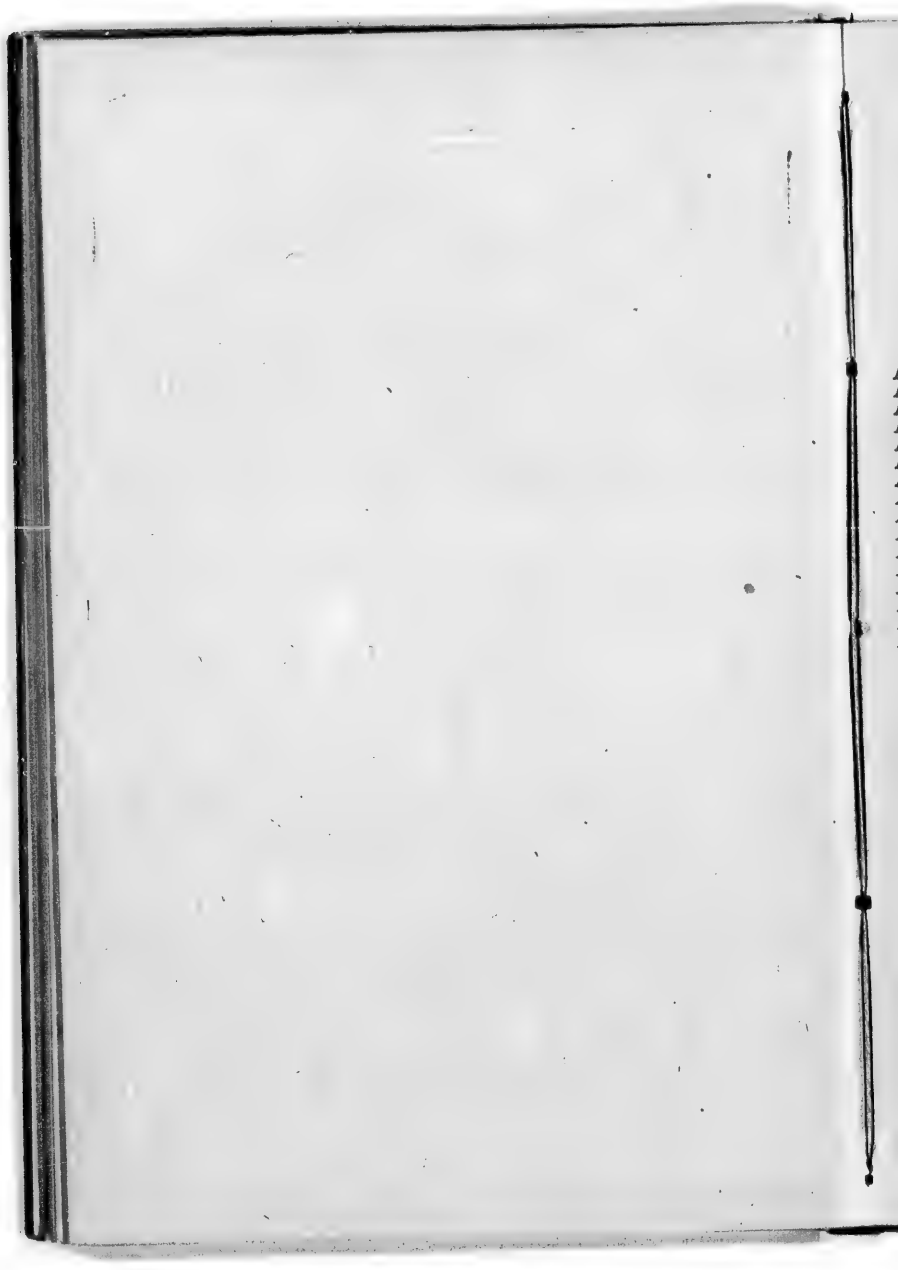

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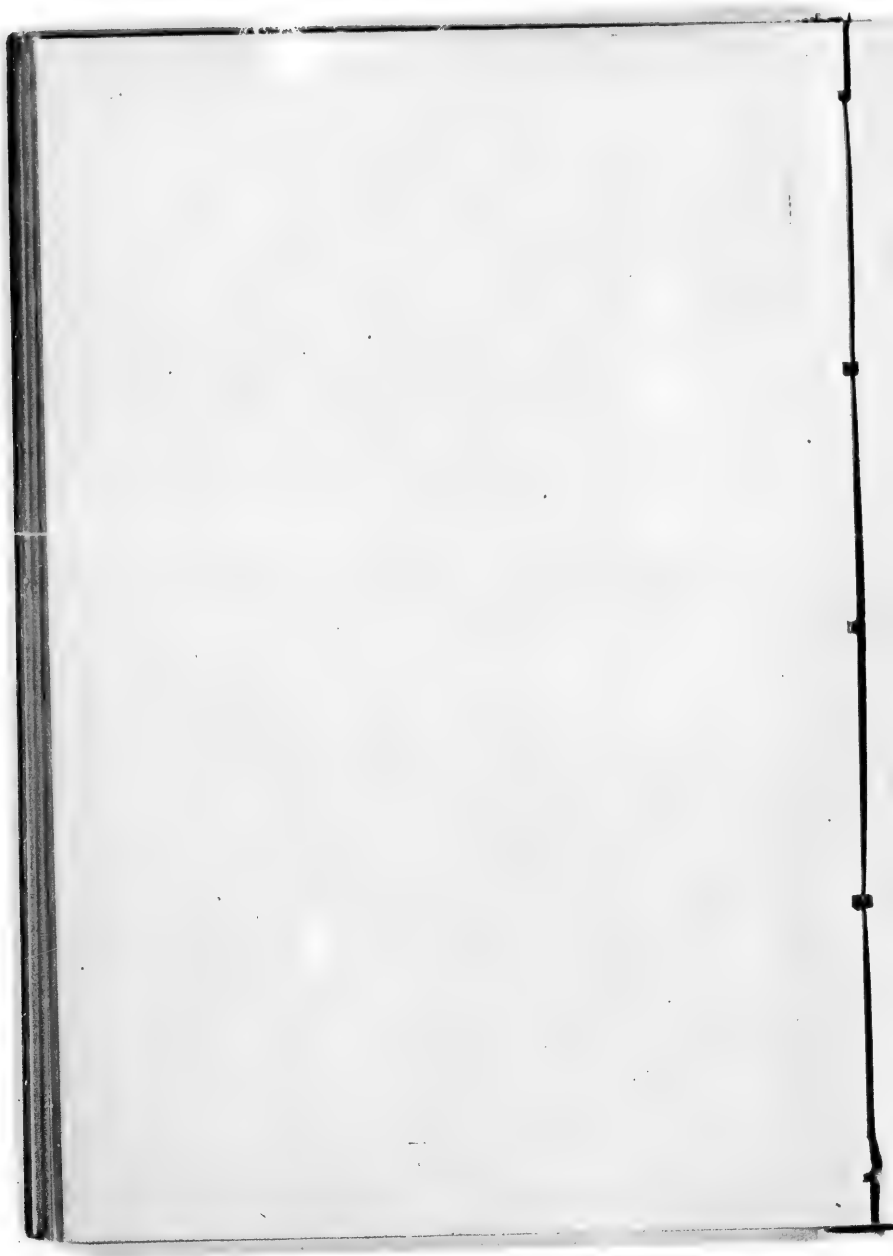

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